

CORRESPONDENCE

Re: Breast Cancer Mortality Among Female Electrical Workers in the United States

Loomis et al. (1) recently reported an elevated risk for breast cancer mortality among female electrical workers in the United States. Their finding was derived from computerized mortality records from 24 states for the years 1985-1989. We were interested in this observation because we recently completed a case-control analysis of breast cancer from the same database (with additional deaths from 1984) to evaluate associations with estimated exposures to a variety of occupational factors by using an occupation/exposure matrix (2).

The primary purpose of this completed work was to identify potential occupational risk factors for breast cancer. Among the exposures we evaluated were radiofrequency electromagnetic fields among white women and among black women through the use of estimates of probability and level of exposure. We found a significant risk elevation for the highest exposure level among white women (odds ratio [OR] = 1.14; 95% confidence interval [CI] = 1.1-1.2) and black women (OR = 1.29; 95% CI = 1.1-1.5). However, risk elevations were modest, there was little evidence of a dose-response gradient with level of exposure, and the ORs for probability of exposure were not significant. When we eliminated women with uncertain exposures, we did not observe an increase in the strength of the association between level of exposure and breast cancer risk, as expected for a causal factor. Our findings did not support the hypothesis that electromagnetic fields in the radiofrequency range are important risk factors for female breast cancer (2). However, this completed analysis did not address extremely low frequency fields.

After publication of the Loomis et al. study, we extended our study to also en-

compass occupational exposure to extremely low frequency fields. We included data from 29 397 white and 4112 black breast cancer decedents and, as a comparison group, 102 955 white and 14 839 black decedents who died of causes other than cancer in 1984-1989. Women whose death records indicated "homemaker" as usual occupation were excluded. An industrial hygienist with expertise in evaluating exposure to extremely low frequency fields rated each of the three-digit U.S. Census Code occupational titles in the data for level and probability of exposure to extremely low frequency fields. In addition, he provided a yes/no estimate for the possibility of occupational use of video display terminals. We calculated the ORs by using standard methods, with adjustment for age and socioeconomic status (as derived from occupational code). This measure of socioeconomic status was a predictor of breast cancer risk and a confounder of many of the exposures we evaluated earlier (2). Results are

shown separately for white women and black women in Table 1.

Among white decedents, we observed no consistent excess risk with increasing level or probability of exposure to extremely low frequency fields. When we examined risk by exposure level among whites and eliminated women with a low, medium, or unknown probability of exposure, the ORs for medium and high levels of exposure did not change. Among black women, there was a significant but modest association of risk with probability of exposure (OR = 1.29 [95% CI = 1.1-1.6]; OR = 1.28 [95% CI = 1.1-1.6] for medium and high probability, respectively), but there were smaller and less consistent associations with exposure level. Neither white nor black women with an elevated probability of using video display terminals experienced elevated breast cancer risk. Thus, in contrast with the results obtained by Loomis et al. (1), our results do not support an association of breast cancer risk with workplace exposure to

Table 1. ORs and 95% CIs for breast cancer and exposure to extremely low frequency electromagnetic radiation or use of video display terminals*

Occupational exposure to extremely low frequency electromagnetic fields or video display terminals	White women			Black women		
	No. of case subjects	No. of control subjects	OR (95% CI)	No. of case subjects	No. of control subjects	OR (95% CI)
Level of exposure to extremely low frequency fields						
None	17 232	55 405	1.0	1917	6060	1.0
Low	9360	32 781	0.94 (0.9-0.96)	1684	6497	0.85 (0.8-0.92)
Medium	1746	7924	1.10 (1.03-1.2)	273	895	1.29 (1.1-1.5)
High	123	403	0.97 (0.8-1.2)	20	44	1.19 (0.7-2.1)
Unknown	936	6442		218	1343	
Probability of exposure to extremely low frequency fields						
None	17 232	55 405	1.0	1917	6060	1.0
Low	8581	29 351	0.92 (0.89-0.95)	1516	5941	0.81 (0.7-0.9)
Medium	779	3430	1.14 (1.05-1.3)	168	556	1.29 (1.06-1.6)
High	1869	8327	1.09 (1.02-1.2)	293	939	1.28 (1.10-1.6)
Unknown	936	6442		218	1343	
Probability of exposure to video display terminals						
None	15 698	57 584	1.0	1086	11 416	1.0
Possible	12 763	38 929	0.98 (0.95-1.01)	808	2080	1.09 (0.98-1.2)
Unknown	936	6442		218	1343	

*Adjusted for age and socioeconomic status, derived from the coded occupation.

extremely low frequency fields. We share Trichopoulos's opinion (3), expressed in an editorial accompanying the study by Loomis et al., that great caution must be observed in interpreting data from death certificates. These mortality data are limited in scope, enhancing the potential for several types of bias. Occupational information was sparse (consisting only of the coded "usual" occupation from the death certificate) and generated by routine reporting with little quality assurance. The specification and coding of the cause of death may have been subject to inaccuracies. In addition, there was no information on reproductive, familial, and other breast cancer risk factors among the study population, and mortality among subgroups of incident breast cancer cases may have differed because of access to medical care. Given these limitations, a reasonable application of these data is the

general screening of job titles or presumed exposures to determine priorities for further study. However, testing the viability or strength of established hypotheses may not be justified. The primary contribution of the work of Loomis et al. (and this analysis) has been to rule out the possibility of very high breast cancer risk associated with exposure to extremely low frequency fields. The possibility of a modest elevation of risk that is causal cannot be addressed by these data.

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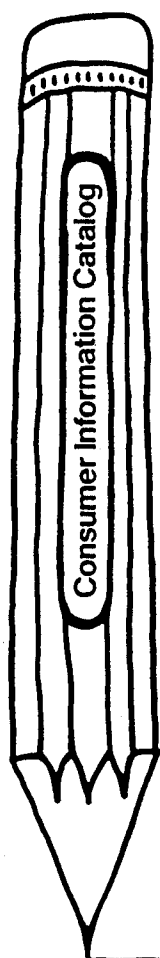
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References

- (1) Loomis DP, Savitz DA, Ananth CV: Breast cancer mortality among female electrical workers in the United States [see comment citation in Medline]. *J Natl Cancer Inst* 86:921-925, 1994
- (2) Cantor KP, Stewart PA, Brinton LA, et al: Occupational exposures and female breast cancer mortality in the United States. *J Occup Med*. In press
- (3) Trichopoulos D: Are electric or magnetic fields affecting mortality from breast cancer in women? [editorial] [see comment citation in Medline]. *J Natl Cancer Inst* 86:885-886, 1994

Note

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